Patent Claims

1. Heat source or heat sink system with thermal ground coupling for near-surface recovery of thermal energy from the ground or for near-surface discharge of thermal energy into the ground, wherein the system comprises at least one ground probe (1) arranged in the ground (3), wherein thermal energy can either be withdrawn from or discharged into the ground (3) by means of a heat transfer fluid supplied through the ground probe (1), wherein each ground probe (1) comprises a metallic probe shaft (2) that is tight against the surrounding ground (3) and consists of several drive-pipe segments (20) driven into the ground (3), and wherein either an immersion pipe (26) that is open at its lower end or a U-shaped pipe loop (29) is arranged in the probe shaft (2) for supplying or removing the heat transfer fluid, characterized in that

- each drive-pipe segment (20) consists of ductile cast iron;
- the drive-pipe segments (20) are formed such that they can be fitted into each other at their ends (21, 22); and
- each drive-pipe segment (20) comprises a tapered outer perimeter (21') at one of its ends and, at its other end, a sleeve (22) provided with a stop shoulder (22'') and having a mating tapered inner perimeter (22'), wherein their diameters and taper angles are dimensioned such that the drive-pipe segments

(20), on being driven in, can be connected to each other in a force-closed and tight manner.

2. System according to Claim 1, characterized in that each tapered outer perimeter (21') of each drive-pipe segment (20) is provided at the forward end (21) of said drive-pipe segment (20) and that the sleeve (22) of each drive-pipe segment (20) that is designed with the stop shoulder (22'') is provided at the backward end of said drive-pipe segment (20).

3. System according to Claim 1 or 2, characterized in that the outer diameter of the immersion pipe (26) is smaller than the inner diameter of the probe shaft (2) and that the length of the immersion pipe (26) is slightly smaller than the length of the probe shaft (2).

4. System according to Claim 1 or 2, characterized in that the length of the U-shaped pipe loop (29) extending up to the latter's U-bend is slightly smaller than the length of the probe shaft (2) and that the part of the interior region (28) of the probe shaft (2) that is not occupied by the pipe loop (29) is filled with a thermally conductive filling material.

5. System according to anyone of the preceding claims, characterized in that the first advancing drive-pipe segment (20) of the probe shaft (2) is, at its forward end (21), provided with or tightly connected to a probe tip (23).

6. System according to anyone of the preceding claims, characterized in that the last drive-pipe segment (20) of the probe shaft (2) is, at its backward end, tightly connected to a connection cover (24) attached after completion of the drive-in procedure, with an inflow line connection (25) and a return flow line connection (27) for the heat transfer fluid being arranged on said connection cover (24).

7. System according to Claim 6, characterized in that the immersion pipe (26) or the pipe loop (29) is solely mounted to or in the connection cover (24).

8. System according to anyone of the preceding claims, characterized in that the immersion pipe (26) or the pipe loop (29) comprises an air vent (29) or a vent valve at its upper end.

9. System according to anyone of the preceding claims, characterized in that the immersion pipe (26) or the pipe loop (29) consists of plastic material, preferably polyethylene (PE) or polypropylene (PP).

10. System according to anyone of the preceding claims, characterized in that the probe shaft (2) is driven into the ground (3) either in vertical direction or in an inclined direction preferably extending at an angle ranging from 15 to 75 degrees in relation to the vertical direction.

11. System according to anyone of the preceding claims, characterized in that the probe shaft (2) is driven into a borehole that has been predrilled into the ground (3), with the maximum depth of the borehole being as great as the length of the probe shaft (2) and with the diameter of the borehole being smaller than the outer diameter of the probe shaft (2).

12. System according to anyone of the preceding claims, characterized in that the wall thickness of each drive-pipe segment (20), with the exception of the region at either of its ends (21, 22), ranges from 10 to 20 percent of the outer diameter of the drive-pipe segment (20).

13. System according to anyone of the preceding claims, characterized in that each drive-pipe segment (20), with the exception of the region at either of its ends (21, 22), comprises an outer diameter approximately ranging from 80 to 200 mm and a wall thickness approximately ranging from 7 to 12 mm.

14. System according to anyone of the preceding claims, characterized in that the length of each drive-pipe segment (20) approximately ranges from 4 to 6 m and is preferably 5 m, and that the total length of the probe shaft (2) approximately ranges from 10 to 50 m and even more if this is permitted by the actual ground conditions.

15. System according to anyone of the preceding claims, characterized in that the heat transfer fluid is

pure water, in particular without any antifreeze additive and in particular under a pressure of an order approximately ranging up to 10 bar.

16. System according to anyone of Claims 1 through 14, characterized in that the heat transfer fluid is carbon dioxide, in particular under a pressure of an order of approximately 100 bar and more.

17. System according to anyone of the preceding claims, characterized in that each drive-pipe segment (20) is provided with an anticorrosive layer on its external and/or internal surface.

18. System according to Claim 17, characterized in that the anticorrosive layer is formed by galvanizing or by a plastic coating, preferably of polyurethane (PU).

- - -